



# 合肥工业大学

## 计算机网络 实验报告

姓 名 袁焕发

学 号 2019217769

专业班级 物联网工程 19-2

指导教师 周健

院系名称 计算机与信息系

2021 年 11 月 17 日

## 一、实验目的

### 1. PPP 协议实验

通过两个由串行线路连接起来的网络设备，在 PPP 协议的支持下进行沟通。通过配置和运行，检验对 PPP 协议及相关知识的掌握程度，增加对课堂理论知识的理解。

### 2. 组网实验

对计算机网络的组网有初步的感性认识，并加深对虚拟局域网的理解。

## 二、实验原理

PPP 协议是一种点到点链路层协议，主要用于在全双工的同异布链路上进行点对点的数据传输。根据 IP 地址可以在两台路由器之间配置 PPP 协议，可以采用 PAP 或者 CHAP 进行认证。PAP 在传输 password 是明文的，而 CHAP 在传输过程中不传输密码，PAP 认证是通过两次握手实现的，而 CHAP 则是通过 3 次握手实现的。

Access 类型的端口只能属于一个 VLAN，一般用于连接计算机端口 Trunk 类型的端口可以允许多个 VLAN 通过，可以接收和发送多个 VLAN 的报文，一般用于交换机之间连接的端口；Hybrid 类型端口，可以允许多个 VLAN 通过，可以接收和发送多个 VLAN 报文，可以用于交换机的间连接也可以用于连接用户计算机，通常用于 trunk 无法满足的场合。

## 三、实验环境

Windows7 操作系统

华为 eNSP 模拟器

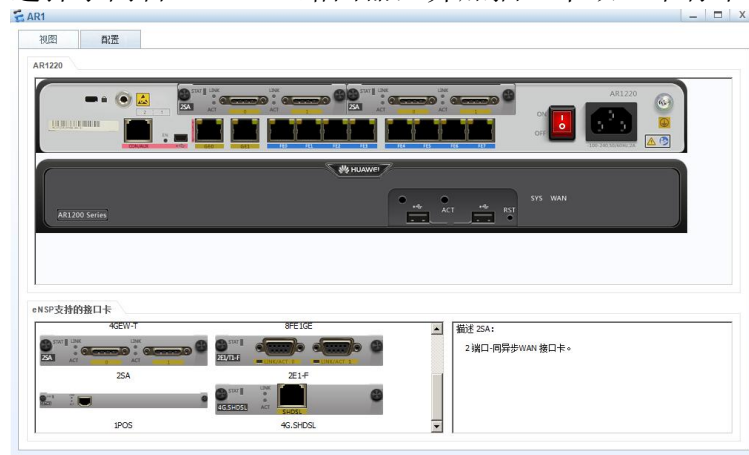
## 四、实验过程（实验一）

### 1. 运行 eNSP

点击“新建拓扑”标签，在主窗口中新建网络拓扑并进行实验。

### 2. 选择设备

选择了两台 AR1220 路由器，并加插一个双口串行卡。



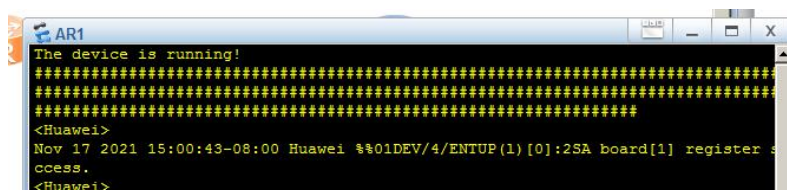
从左上角的“设备连线”窗口选择“连线”图标，在其下面的窗口中会出现多种不同类型的传输媒介。本实验只用到铜导线 Copper）和串行线（Serial）。选择串行线，再右击路由器，会出现此路由器的各种接口，选

择一个合适的接口即可。

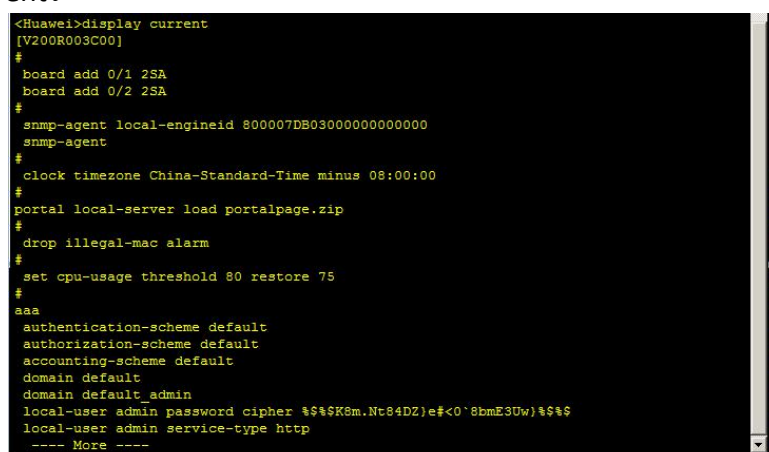
选择两台计算机（PC），并分别利用铜导线将计算机与路由器连接在一起。注意，在连接路由器时要选择千兆以太网网口，即选择“GigaBitEthernet”的接口，而不要选择百兆的“Ethernet”接口。因为 AR 系列路由器的千兆接口默认可以配置 IP 地址，而百兆接口只是数据链路层接口，不能配置 IP 地址。

### 3. 网络配置

右击路由器 AR1，选择“启动”。启动完成后再次右击路由器，选择“命令行”（CLI）。命令行窗口启动，并最终显示提示符为<Huawei>时，表示已经启动完成，进入用户视图。



在用户视图下可以尝试进行一些查看，如输入查看当前配置命令：display current。



进行设备配置时必须进入系统视图，即在用户视图输入：system-view 出现[Huawei]说明已经进入系统视图，可以进行配置操作。

AR1 的配置：

[Huawei]sysname R1 #将该路由器命名为 R1，可不命名。

[R1]interface gigabitEthernet0/0/0

#进入千兆接口 0/0/0 的接口视图

[R1-GigabitEthernet0/0/0]ip address 192.168.1.254 24

#将该接口与 IP 地址绑定

[R1] interface serial2/0/0 #进入串口 2/0/0 的接口视图

[R1-Serial2/0/0]ip address 10.0.0.1 8

#将该接口与 IP 地址绑定

[R1]aaa #进入 AAA 认证视图

[R1-aaa]local-user huawei password cipher 123456

#用户为 huawei，密码 123456

[R1-aaa]local-user huawei service-type ppp

#用户 huawei 的服务类型是 PPP  
[R1]interface serial2/0/0  
[R1-Serial2/0/0]ppp authentication-mode pap  
#PPP 认证方式为 PAP  
[R1]ip route-static 0.0.0.0 0.0.0.0 10.0.0.2  
#设置一个静态路由  
[R1]quit #退出系统视图  
<R1>save #保存配置  
至此，路由器 AR1 配置完成。

```
[R1]interface gigabitEthernet0/0/0
[R1-GigabitEthernet0/0/0]ip address 192.168.1.254 24
[R1-GigabitEthernet0/0/0]interface serial2/0/0
[R1-Serial2/0/0]ip address 10.0.0.1 8
[R1-Serial2/0/0]quit
[R1]aaa
[R1-aaa]local-user huawei password cipher 123456
Info: Add a new user.
[R1-aaa]local-user huawei service-type ppp
[R1-aaa]quit
[R1]interface serial2/0/0
[R1-Serial2/0/0]ppp authentication-mode pap
[R1-Serial2/0/0]quit
[R1]ip route-static 0.0.0.0 0.0.0.0 10.0.0.2
[R1]quit
<R1>save
  The current configuration will be written to the device.
  Are you sure to continue? (y/n)[n]:y
  It will take several minutes to save configuration file, please wait.....
.....
```

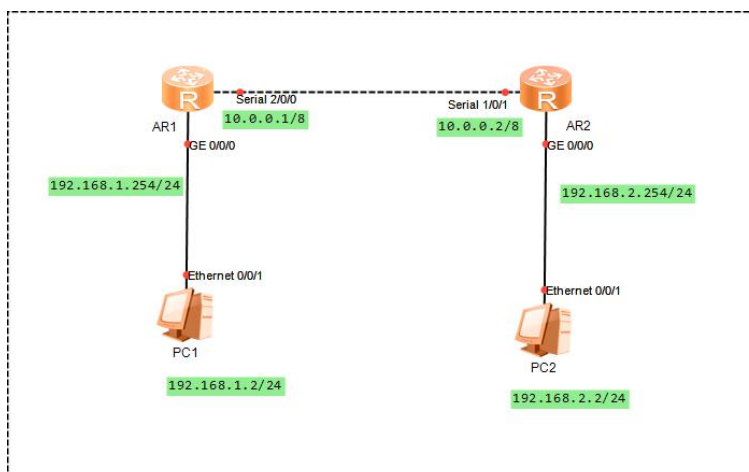
AR2 的配置:

```
<Huawei>system-view
[Huawei]sysname R2
[R2]interface serial1/0/1
[R2-Serial1/0/1]ip address 10.0.0.2 8
[R2-Serial1/0/1]ppp pap local-user huawei password cipher
123456
[R2]interface gigabitEthernet0/0/0
[R2-GigabitEthernet0/0/0]ip address 192.168.2.254 24
[R2]ip route-static 0.0.0.0 0.0.0.0 10.0.0.1
[R2]quit
<R2>save
```

```
AR2
Please press enter to start cmd line!

<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]sysname R2
[R2]interface serial1/0/1
[R2-Serial1/0/1]ip address 10.0.0.2 8
[R2-Serial1/0/1]
Nov 17 2021 15:25:13-08:00 R2 %01IFNET/4/LINK_STATE(1)[0]:The line protocol IP
.IPCP on the interface Serial1/0/1 has entered the UP state.
[R2-Serial1/0/1]ppp pap local-user huawei cipher 123456
      ^
Error: Unrecognized command found at '^' position.
[R2-Serial1/0/1]ppp pap local-user huawei password cipher 123456
      ^
Error: Unrecognized command found at '^' position.
[R2-Serial1/0/1]ppp pap local-user huawei password cipher 123456
[R2-Serial1/0/1]interface gigabitethernet0/0/0
[R2-GigabitEthernet0/0/0]ip address 192.168.2.254 24
Nov 17 2021 15:27:12-08:00 R2 %01IFNET/4/LINK_STATE(1)[1]:The line protocol IP
on the interface GigabitEthernet0/0/0 has entered the UP state.
[R2-GigabitEthernet0/0/0]quit
[R2]ip route-static 0.0.0.0 0.0.0.0 10.0.0.1
[R2]quit
<R2>save
```

计算机配置非常简单，与通常的计算机网络设置完全相同。需要注意的是：用对应路由器的千兆口配置的 IP 地址作为计算机的网关地址，DNS 任意。



从 PC1 的命令行窗口发出 ping 命令，可以测试配置的是否成功：

```
PC>ping 192.168.2.2

Ping 192.168.2.2: 32 data bytes, Press Ctrl_C to break
Request timeout!
From 192.168.2.2: bytes=32 seq=2 ttl=126 time=62 ms
From 192.168.2.2: bytes=32 seq=3 ttl=126 time=31 ms
From 192.168.2.2: bytes=32 seq=4 ttl=126 time=32 ms
From 192.168.2.2: bytes=32 seq=5 ttl=126 time=31 ms

--- 192.168.2.2 ping statistics ---
 5 packet(s) transmitted
 4 packet(s) received
20.00% packet loss
round-trip min/avg/max = 0/39/62 ms

PC>
```

#### 4. 按照要求修改后

实验中所涉及的 IP 地址要用学生的学号相关数字替代，具体为：IP 地址的第三段数字改为 100+学号的第 7、8 位数字+原来的数字，如某位同学的学号为 20192156\*\*示例中的 IP 地址为 10.0.0.1 改为 10.0.100+56.1，



即改变为 10.0.156.1。

```
<R1>
Nov 17 2021 15:45:19-08:00 R1 %01IFNET/4/IF_ENABLE(1)[2]:Interface Serial2/0/1
has been available.
<R1>system-view
Enter system view, return user view with Ctrl+Z.
[R1]interface gigabitethernet0/0/0
[R1-GigabitEthernet0/0/0]ip address 192.168.177.254 24
[R1-GigabitEthernet0/0/0]quit
[R1]interface serial2/0/0
[R1-Serial2/0/0]ip address 10.0.177.1 8
[R1-Serial2/0/0]ip route-static 0.0.0.0 0.0.0.0 10.0.177.2
[R1]quit
<R1>save
^
Error: Unrecognized command found at '^' position.
<R1>save
The current configuration will be written to the device.
Are you sure to continue? (y/n)[n]:y
It will take several minutes to save configuration file, please wait.....
.....

#####
<R2>
Nov 17 2021 16:18:36-08:00 R2 %01IFNET/4/IF_ENABLE(1)[0]:Interface Serial1/0/0
has been available.
<R2>
Nov 17 2021 16:18:36-08:00 R2 %01IFNET/4/IF_ENABLE(1)[1]:Interface Serial1/0/1
has been available.
<R2>system-view
Enter system view, return user view with Ctrl+Z.
[R2]interface serial1/0/1
[R2-Serial1/0/1]ip address 10.0.177.2 8
[R2-Serial1/0/1]quit
^
Error: Unrecognized command found at '^' position.
[R2-Serial1/0/1]quit
[R2]interface gigabitethernet0/0/0
[R2-GigabitEthernet0/0/0]ip address 192.168.178.254 24
[R2-GigabitEthernet0/0/0]quit
[R2]ip route-static 0.0.0.0 0.0.0.0 10.0.177.1
[R2]quit
<R2>save
The current configuration will be written to the device.
Are you sure to continue? (y/n)[n]:y
It will take several minutes to save configuration file, please wait.....
```

基础配置	命令行	组播	UDP发工具	串口
------	-----	----	--------	----

```
From 192.168.177.2: Destination host unreachable
From 192.168.177.2: Destination host unreachable
From 192.168.177.2: Destination host unreachable
From 192.168.177.2: Destination host unreachable

--- 192.168.177.254 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 192.168.178.2

Ping 192.168.178.2: 32 data bytes, Press Ctrl_C to break
Request timeout!
Request timeout!
From 192.168.178.2: bytes=32 seq=3 ttl=126 time=46 ms
From 192.168.178.2: bytes=32 seq=4 ttl=126 time=31 ms
From 192.168.178.2: bytes=32 seq=5 ttl=126 time=16 ms

--- 192.168.178.2 ping statistics ---
 5 packet(s) transmitted
 3 packet(s) received
40.00% packet loss
round-trip min/avg/max = 0/31/46 ms

PC>
```

尝试在认证时使用不一致的密码，并进行连通实验，给出 ping 的结果。

```
<R2>
<R2>system-view
Enter system view, return user view with Ctrl+Z.
[R2]interface serial1/0/1
[R2-Serial1/0/1]ppp pap local-user huawei password cipher 654321
[R2-Serial1/0/1]quit
[R2]save
^
Error: Unrecognized command found at '^' position.
[R2]quit
<R2>save
The current configuration will be written to the device.
Are you sure to continue? (y/n)[n]:y
It will take several minutes to save configuration file, please wait.....
Configuration file had been saved successfully
Note: The configuration file will take effect after being activated
<R2>
```

```
PC1
基础配置 命令行 组播 UDP发包工具 串口
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!

--- 192.168.178.2 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 192.168.178.2

Ping 192.168.178.2: 32 data bytes, Press Ctrl_C to break
Request timeout!
Request timeout!
Request timeout!
Request timeout!
Request timeout!

--- 192.168.178.2 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

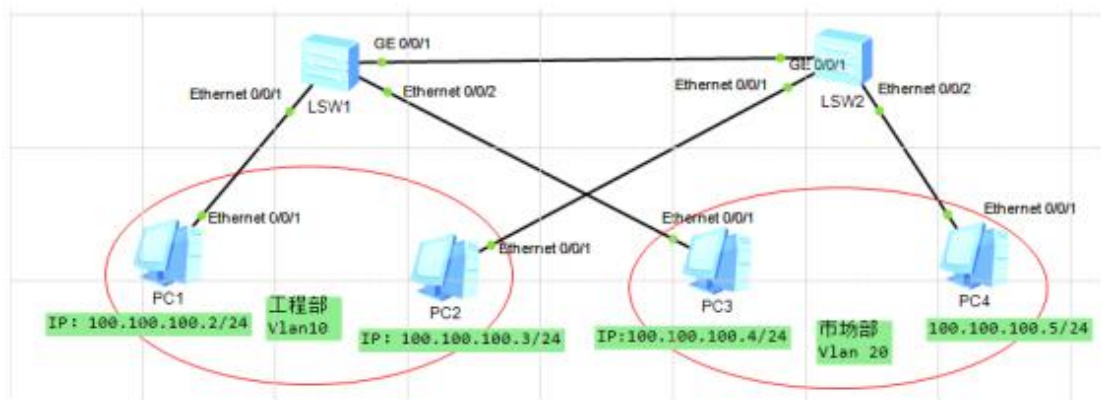
PC> |
```

## 5. 结果及结论:

PC1 和 PC2 之间握手认证时, PAP 认证密码错误, 无法连通。被认证方向认证方发送认证请求(包含用户名和密码), 以明文形式进行传输, 认证方接到认证请求, 再根据被认证方发送来的用户名去到自己的数据库认证用户名密码是否正确, 如果密码正确, PAP 认证通过, 如果用户名密码错误, PAP 认证未通过 PAP 并不是一种强有效的认证方法, 其密码以文本格式在电路上进行发送, 对于窃听、重放或重复尝试和错误攻击没有任何保护。

## 五、实验过程(实验二)

某单位有工程部和市场部两个部门, 各有 2 台联网电脑, IP 地址、mac 地址等见下图:



PC1 和 PC2 同属工程部能相互连通，PC3 和 PC4 能相互连通，同时工程部与市场部的电脑相互之间不能互通。首先建立网络，按照上图要求选择交换机、PC 和传输介质，并组成网络

## 1. 配置交换机 LSW1

首先，配置 Vlan。双击交换机 LSW1，进入用户视图：

System-view #进入系统视图

Display Vlan #查看当前交换机 Vlan 情况

```

LSW1
<Huawei>
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]display vlan
The total number of vlans is : 1

-----
U: Up;          D: Down;          TG: Tagged;      UT: Untagged;
MP: Vlan-mapping;  ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----

VID  Type    Ports
-----
1    common  UT:Eth0/0/1 (D)  Eth0/0/2 (D)  Eth0/0/3 (D)  Eth0/0/4 (D)
                        Eth0/0/5 (D)  Eth0/0/6 (D)  Eth0/0/7 (D)  Eth0/0/8 (D)
                        Eth0/0/9 (D)  Eth0/0/10 (D) Eth0/0/11 (D) Eth0/0/12 (D)
                        Eth0/0/13 (D) Eth0/0/14 (D) Eth0/0/15 (D) Eth0/0/16 (D)
                        Eth0/0/17 (D) Eth0/0/18 (D) Eth0/0/19 (D) Eth0/0/20 (D)
                        Eth0/0/21 (D) Eth0/0/22 (D) GE0/0/1 (D)   GE0/0/2 (D)

VID  Status  Property  MAC-LRN  Statistics  Description
-----
1    enable  default  enable  disable  VLAN 0001
[Huawei]

```

上图说明目前交换机 LSW1 只有 Vlan 1 一个虚拟局域网，本交换机的所有端口全部在该局域网中。其中 eth0/0/1 和 eth0/0/2 两个以太网端口处于活跃状态，因为已经通过媒介与 PC 连接；其他端口处于 down 状态，因为都没有连接任何设备。

Vlan batch 10 20 #在创建 VID 为 10 和 20 的两个 vlan。



```
[Huawei]vlan batch 10 20
Info: This operation may take a few seconds. Please wait for a moment...done.
[Huawei]
```

Display Vlan #查看当前交换机 Vlan 情况

U: Up; D: Down; TG: Tagged; UT: Untagged;  
MP: Vlan-mapping; ST: Vlan-stacking;  
#: ProtocolTransparent-vlan; \*: Management-vlan;

VID	Type	Ports
1	common	Eth0/0/1 (D) Eth0/0/2 (D) Eth0/0/3 (D) Eth0/0/4 (D) Eth0/0/5 (D) Eth0/0/6 (D) Eth0/0/7 (D) Eth0/0/8 (D) Eth0/0/9 (D) Eth0/0/10 (D) Eth0/0/11 (D) Eth0/0/12 (D) Eth0/0/13 (D) Eth0/0/14 (D) Eth0/0/15 (D) Eth0/0/16 (D) Eth0/0/17 (D) Eth0/0/18 (D) Eth0/0/19 (D) Eth0/0/20 (D) Eth0/0/21 (D) Eth0/0/22 (D) GE0/0/1 (D) GE0/0/2 (D)
10	common	
20	common	

VID	Status	Property	MAC-LRN	Statistics	Description
1	enable	default	enable	disable	VLAN 0001
10	enable	default	enable	disable	VLAN 0010
20	enable	default	enable	disable	VLAN 0020

[Huawei]

但是尚无任何端口加入其中，只是两个空 Vlan。

将端口 1 和端口 2 分别加入到 vlan10 和 vlan20 中。

```
[Huawei]interface ethernet 0/0/1
[Huawei-Ethernet0/0/1]port link-type access
[Huawei-Ethernet0/0/1]port default vlan 10
[Huawei-Ethernet0/0/1]quit
Nov 17 2021 16:48:17-08:00 Huawei DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.2011.
.25.191.3.1 configurations have been changed. The current change number is 6, t
e change loop count is 0, and the maximum number of records is 4095.
[Huawei]interface ethernet 0/0/2
[Huawei-Ethernet0/0/2]port link-type access
[Huawei-Ethernet0/0/2]
Nov 17 2021 16:48:47-08:00 Huawei DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.2011.
.25.191.3.1 configurations have been changed. The current change number is 7, t
e change loop count is 0, and the maximum number of records is 4095.
[Huawei-Ethernet0/0/2]port default vlan 20
[Huawei-Ethernet0/0/2]quit
[Huawei]
Nov 17 2021 16:49:07-08:00 Huawei DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.2011.
.25.191.3.1 configurations have been changed. The current change number is 8, t
e change loop count is 0, and the maximum number of records is 4095.
```

再次查看 vlan 情况如下：

LSW1

U: Up; D: Down; TG: Tagged; UT: Untagged;  
 MP: Vlan-mapping; ST: Vlan-stacking;  
 #: ProtocolTransparent-vlan; \*: Management-vlan;

VID	Type	Ports
1	common	UT:Eth0/0/3 (D) Eth0/0/4 (D) Eth0/0/5 (D) Eth0/0/6 (D) Eth0/0/7 (D) Eth0/0/8 (D) Eth0/0/9 (D) Eth0/0/10 (D) Eth0/0/11 (D) Eth0/0/12 (D) Eth0/0/13 (D) Eth0/0/14 (D) Eth0/0/15 (D) Eth0/0/16 (D) Eth0/0/17 (D) Eth0/0/18 (D) Eth0/0/19 (D) Eth0/0/20 (D) Eth0/0/21 (D) Eth0/0/22 (D) GE0/0/1 (D) GE0/0/2 (D)
10	common	UT:Eth0/0/1 (D)
20	common	UT:Eth0/0/2 (D)

VID	Status	Property	MAC-LRN	Statistics	Description
1	enable	default	enable	disable	VLAN 0001
10	enable	default	enable	disable	VLAN 0010
20	enable	default	enable	disable	VLAN 0020

[Huawei]

从上图可以看到，在 vlan10 和 20 中分别加入一个端口，而在默认 vlan 中则少了 Ethernet0/0/1 和 ethernet0/0/2 端口。

接着配置 trunk 端口：

```
[Huawei]interface gigabitethernet 0/0/1
[Huawei-GigabitEthernet0/0/1]port link-type trunk
[Huawei-GigabitEthernet0/0/1]
Nov 17 2021 16:51:17-08:00 Huawei DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.2011.
.25.191.3.1 configurations have been changed. The current change number is 9, t
e change loop count is 0, and the maximum number of records is 4095.
[Huawei-GigabitEthernet0/0/1]port trunk vlan 10 20
^
Error: Unrecognized command found at '^' position.
[Huawei-GigabitEthernet0/0/1]quit
[Huawei]
```

将 GigabitEthernet 0/0/1 千兆以太网口设置为 trunk 端口，并且允许 vlan10 和 vlan20 两个局域网的数据包经过，即将本端口分别加入了 vlan10 和 vlan20，再次查看交换机 LSW1 的 vlan 情况：

```

LSW1
U: Up;          D: Down;          TG: Tagged;          UT: Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----
VID  Type  Ports
-----
1    common  UT:Eth0/0/3 (D)  Eth0/0/4 (D)  Eth0/0/5 (D)  Eth0/0/6 (D)
                Eth0/0/7 (D)  Eth0/0/8 (D)  Eth0/0/9 (D)  Eth0/0/10 (D)
                Eth0/0/11 (D) Eth0/0/12 (D) Eth0/0/13 (D) Eth0/0/14 (D)
                Eth0/0/15 (D) Eth0/0/16 (D) Eth0/0/17 (D) Eth0/0/18 (D)
                Eth0/0/19 (D) Eth0/0/20 (D) Eth0/0/21 (D) Eth0/0/22 (D)
                GE0/0/1 (D)  GE0/0/2 (D)
10   common  UT:Eth0/0/1 (D)
20   common  UT:Eth0/0/2 (D)

VID  Status  Property  MAC-LRN  Statistics  Description
-----
1    enable  default  enable  disable  VLAN 0001
10   enable  default  enable  disable  VLAN 0010
20   enable  default  enable  disable  VLAN 0020
[Huawei]

```

可以发现: vlan10 和 vlan20 都增加了一个 GE0/0/1 千兆以太网端口, 并且在 vlan1 中 GE0/0/1 端口依然存在。至此, 交换机 LSW1 配置完成。发出 quit 命令, 回到用户视图, 再发 save 命令保存配置。一定要用 save 保存配置, ensp 的保存文件仅保存拓扑图, 各设备的配置数据并不保存。

## 2. 配置 LSW2

仿照 LSW1, 可以很轻松的完成交换机 LSW2 配置, 这里不再赘述。

要注意的是:

在 LSW2 交换机中也同样建立 vlan10 和 vlan20, 并将相应端口纳入到对应的 vlan 中; 将 GigabitEthernet 0/0/1 千兆以太网口设置为 trunk 端口, 并允许 vlan10 和 vlan20 的数据包通过。全部配置完成后进行连通性测试。

## 3. 连通性测试

测试 PC1 与 PC2、PC3 和 PC4 的连通性:

```

PC1
基础配置  命令行  组播  UDP发包工具  串口
Welcome to use PC Simulator!

PC>ping 100.100.177.3

Ping 100.100.177.3: 32 data bytes, Press Ctrl_C to break
From 100.100.177.3: bytes=32 seq=1 ttl=128 time=62 ms
From 100.100.177.3: bytes=32 seq=2 ttl=128 time=78 ms
From 100.100.177.3: bytes=32 seq=3 ttl=128 time=78 ms
From 100.100.177.3: bytes=32 seq=4 ttl=128 time=47 ms
From 100.100.177.3: bytes=32 seq=5 ttl=128 time=63 ms

--- 100.100.177.3 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/65/78 ms

```



```

PC>ping 100.100.177.4

Ping 100.100.177.4: 32 data bytes, Press Ctrl_C to break
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable

--- 100.100.177.4 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

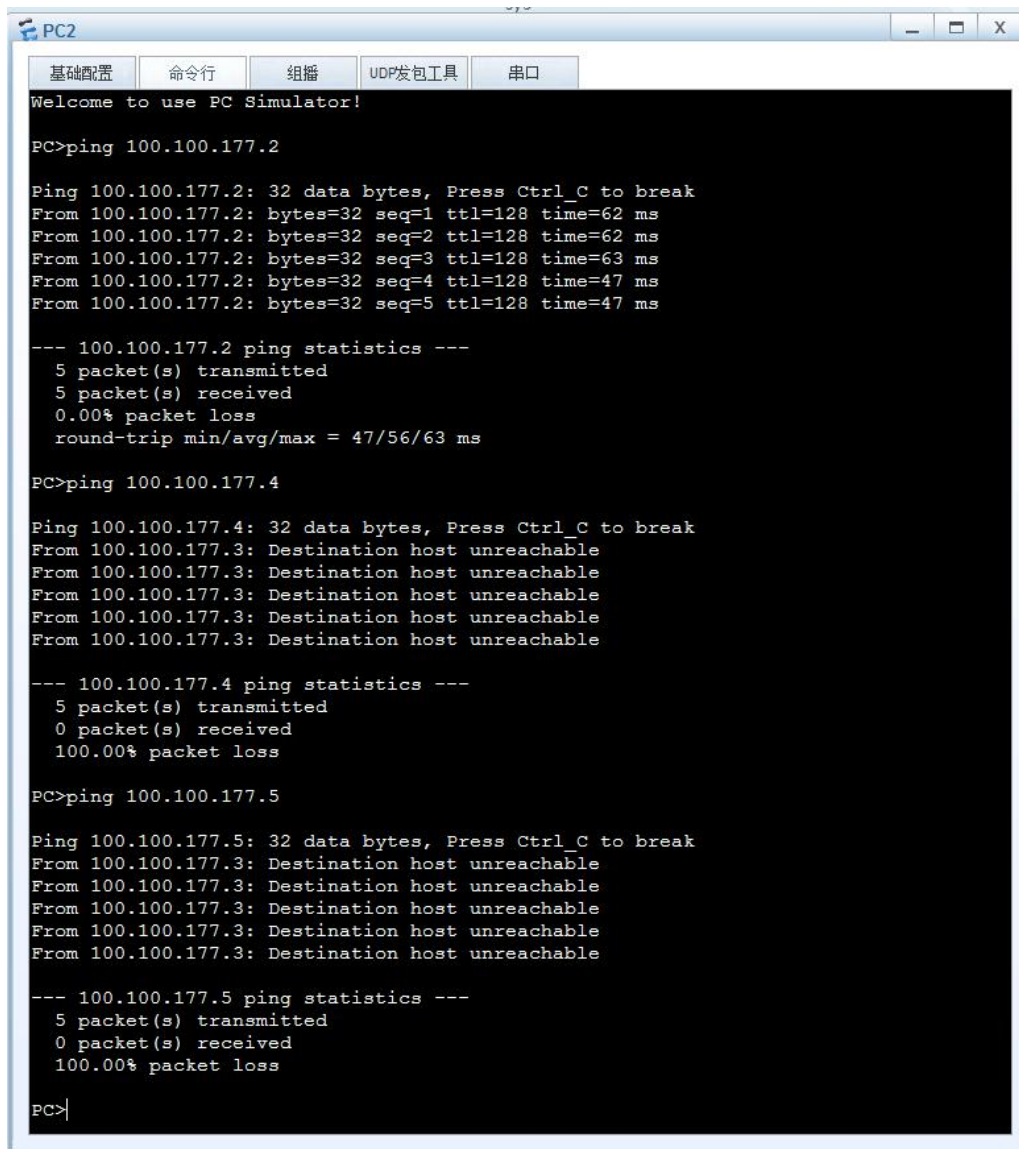
PC>ping 100.100.177.5

Ping 100.100.177.5: 32 data bytes, Press Ctrl_C to break
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable

--- 100.100.177.5 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

```

指明 PC1 能与 PC2 连通, 无法与 PC3、PC4 连通。  
再测试 PC2 与 PC1、PC3 和 PC4 的连通性:



The screenshot shows a window titled "PC2" with tabs for "基础配置", "命令行", "组播", "UDP发包工具", and "串口". The "命令行" tab is active, displaying the following text:

```

Welcome to use PC Simulator!

PC>ping 100.100.177.2

Ping 100.100.177.2: 32 data bytes, Press Ctrl_C to break
From 100.100.177.2: bytes=32 seq=1 ttl=128 time=62 ms
From 100.100.177.2: bytes=32 seq=2 ttl=128 time=62 ms
From 100.100.177.2: bytes=32 seq=3 ttl=128 time=63 ms
From 100.100.177.2: bytes=32 seq=4 ttl=128 time=47 ms
From 100.100.177.2: bytes=32 seq=5 ttl=128 time=47 ms

--- 100.100.177.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
   round-trip min/avg/max = 47/56/63 ms

PC>ping 100.100.177.4

Ping 100.100.177.4: 32 data bytes, Press Ctrl_C to break
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable

--- 100.100.177.4 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

PC>ping 100.100.177.5

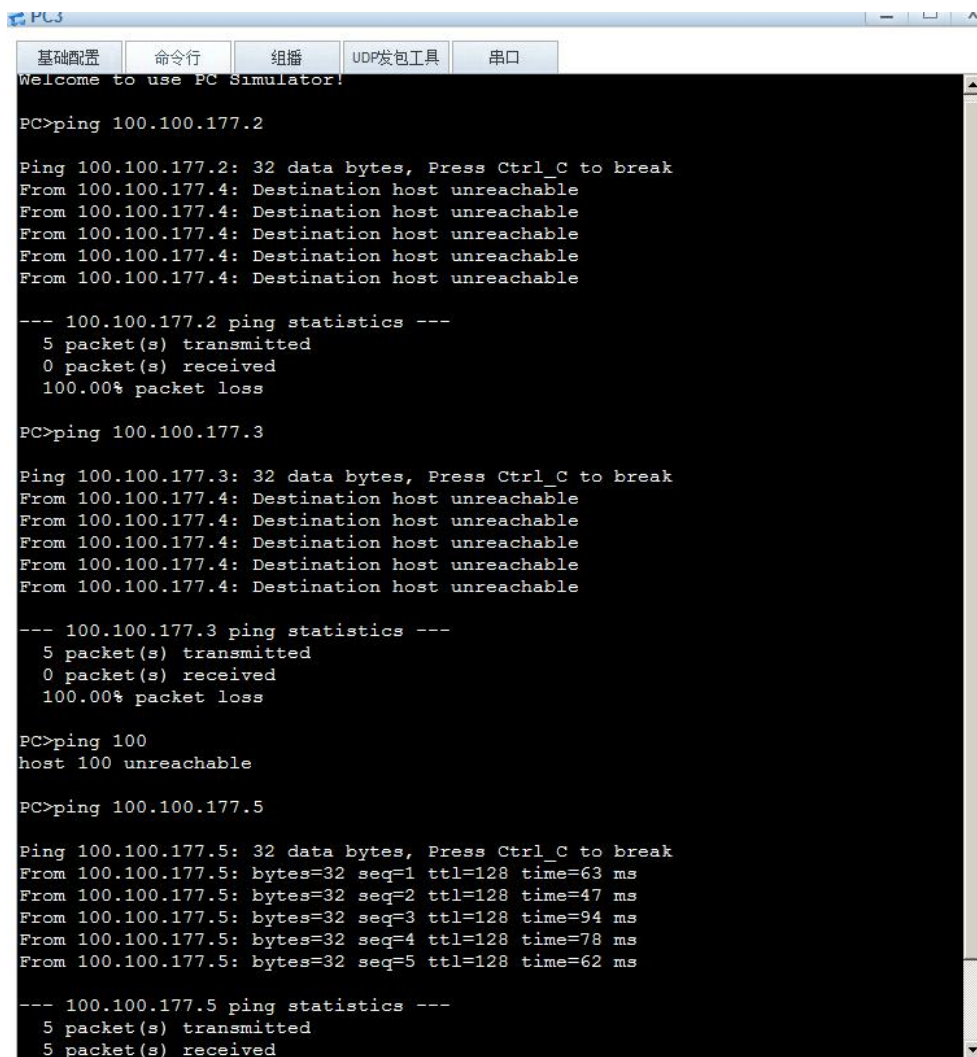
Ping 100.100.177.5: 32 data bytes, Press Ctrl_C to break
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable

--- 100.100.177.5 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

PC>

```

再测试 PC3 与 PC1、PC2 和 PC4 的连通性：



```
PC3
基础配置 命令行 组播 UDP发包工具 串口
Welcome to use PC Simulator!

PC>ping 100.100.177.2

Ping 100.100.177.2: 32 data bytes, Press Ctrl_C to break
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable

--- 100.100.177.2 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 100.100.177.3

Ping 100.100.177.3: 32 data bytes, Press Ctrl_C to break
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable

--- 100.100.177.3 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

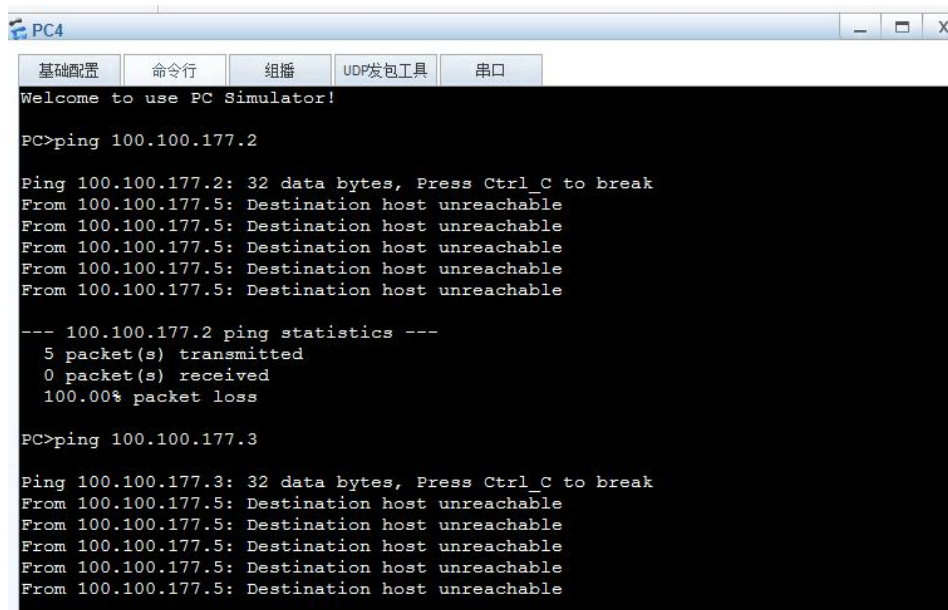
PC>ping 100
host 100 unreachable

PC>ping 100.100.177.5

Ping 100.100.177.5: 32 data bytes, Press Ctrl_C to break
From 100.100.177.5: bytes=32 seq=1 ttl=128 time=63 ms
From 100.100.177.5: bytes=32 seq=2 ttl=128 time=47 ms
From 100.100.177.5: bytes=32 seq=3 ttl=128 time=94 ms
From 100.100.177.5: bytes=32 seq=4 ttl=128 time=78 ms
From 100.100.177.5: bytes=32 seq=5 ttl=128 time=62 ms

--- 100.100.177.5 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
```

最后测试 PC4 与 PC1、PC2 和 PC3 的连通性：



```
PC4
基础配置 命令行 组播 UDP发包工具 串口
Welcome to use PC Simulator!

PC>ping 100.100.177.2

Ping 100.100.177.2: 32 data bytes, Press Ctrl_C to break
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable

--- 100.100.177.2 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 100.100.177.3

Ping 100.100.177.3: 32 data bytes, Press Ctrl_C to break
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
```



```
PC>ping 100.100.177.4

Ping 100.100.177.4: 32 data bytes, Press Ctrl_C to break
From 100.100.177.4: bytes=32 seq=1 ttl=128 time=47 ms
From 100.100.177.4: bytes=32 seq=2 ttl=128 time=78 ms
From 100.100.177.4: bytes=32 seq=3 ttl=128 time=47 ms
From 100.100.177.4: bytes=32 seq=4 ttl=128 time=62 ms
From 100.100.177.4: bytes=32 seq=5 ttl=128 time=63 ms

--- 100.100.177.4 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/59/78 ms

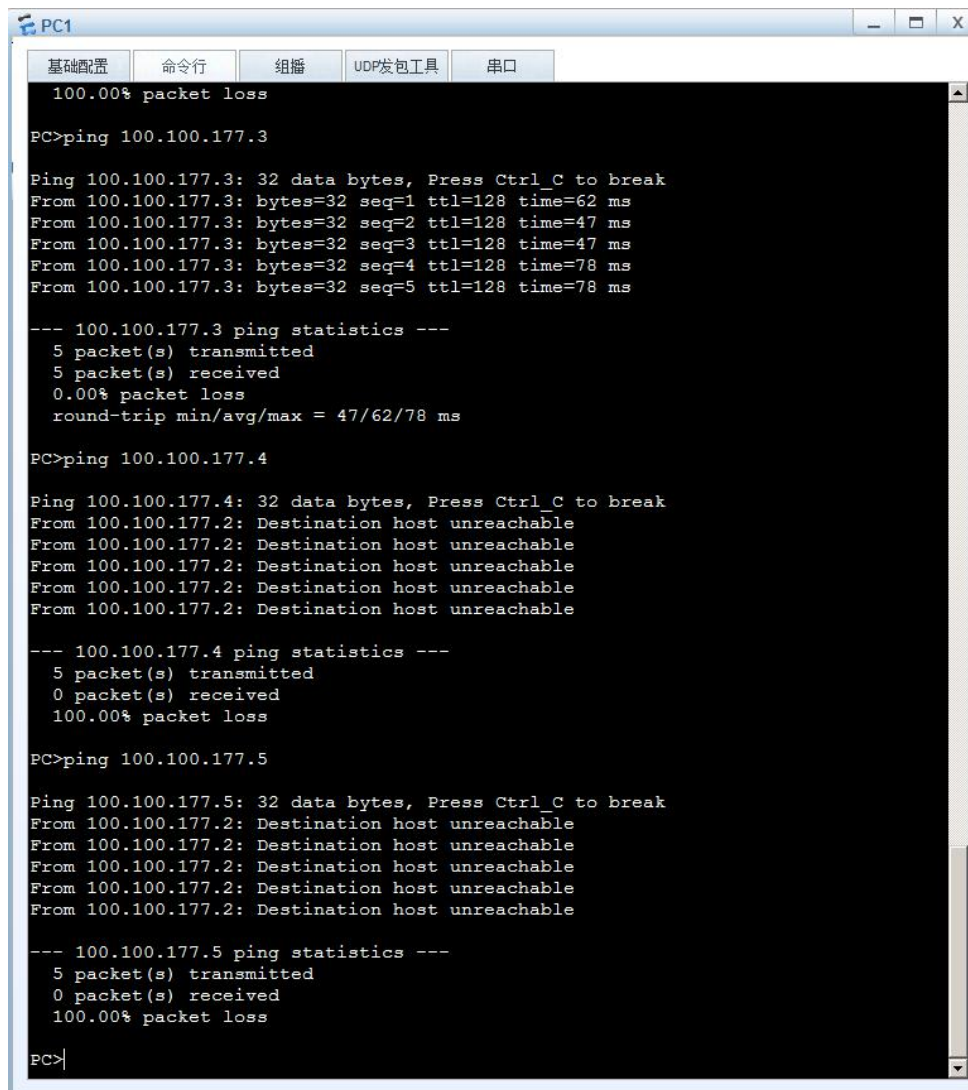
PC>
```

#### 4. 根据要求修改实验

尝试在配置 trunk 时只将部分 vlan 加入或者只在一端加入 vlan，给出 ping 的结果。

修改后 LSW2 只配置 vlan10: undo port trunk allow-pass vlan 20。

测试 PC1 与 PC2、PC3 和 PC4 的连通性：



```
PC1
基础配置 命令行 组播 UDP发包工具 串口
100.00% packet loss

PC>ping 100.100.177.3

Ping 100.100.177.3: 32 data bytes, Press Ctrl_C to break
From 100.100.177.3: bytes=32 seq=1 ttl=128 time=62 ms
From 100.100.177.3: bytes=32 seq=2 ttl=128 time=47 ms
From 100.100.177.3: bytes=32 seq=3 ttl=128 time=47 ms
From 100.100.177.3: bytes=32 seq=4 ttl=128 time=78 ms
From 100.100.177.3: bytes=32 seq=5 ttl=128 time=78 ms

--- 100.100.177.3 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/62/78 ms

PC>ping 100.100.177.4

Ping 100.100.177.4: 32 data bytes, Press Ctrl_C to break
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable

--- 100.100.177.4 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 100.100.177.5

Ping 100.100.177.5: 32 data bytes, Press Ctrl_C to break
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable
From 100.100.177.2: Destination host unreachable

--- 100.100.177.5 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>
```

测试 PC2 与 PC1、PC3 和 PC4 的连通性：

```
PC2
Welcome to use PC Simulator!

PC>ping 100.100.177.2

Ping 100.100.177.2: 32 data bytes, Press Ctrl_C to break
From 100.100.177.2: bytes=32 seq=1 ttl=128 time=62 ms
From 100.100.177.2: bytes=32 seq=2 ttl=128 time=63 ms
From 100.100.177.2: bytes=32 seq=3 ttl=128 time=63 ms
From 100.100.177.2: bytes=32 seq=4 ttl=128 time=62 ms
From 100.100.177.2: bytes=32 seq=5 ttl=128 time=62 ms

--- 100.100.177.2 ping statistics ---
    5 packet(s) transmitted
    5 packet(s) received
    0.00% packet loss
    round-trip min/avg/max = 62/62/63 ms

PC>ping 100.100.177.4

Ping 100.100.177.4: 32 data bytes, Press Ctrl_C to break
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable

--- 100.100.177.4 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

PC>ping 100.100.177.5

Ping 100.100.177.5: 32 data bytes, Press Ctrl_C to break
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable
From 100.100.177.3: Destination host unreachable

--- 100.100.177.5 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

PC>|
```

测试 PC3 与 PC1、PC2 和 PC4 的连通性:

```
PC3
PC>ping 100.100.177.2

Ping 100.100.177.2: 32 data bytes, Press Ctrl_C to break
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable

--- 100.100.177.2 ping statistics ---
    5 packet(s) transmitted
    0 packet(s) received
   100.00% packet loss

PC>ping 100.100.177.3

Ping 100.100.177.3: 32 data bytes, Press Ctrl_C to break
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
```

```
--- 100.100.177.3 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

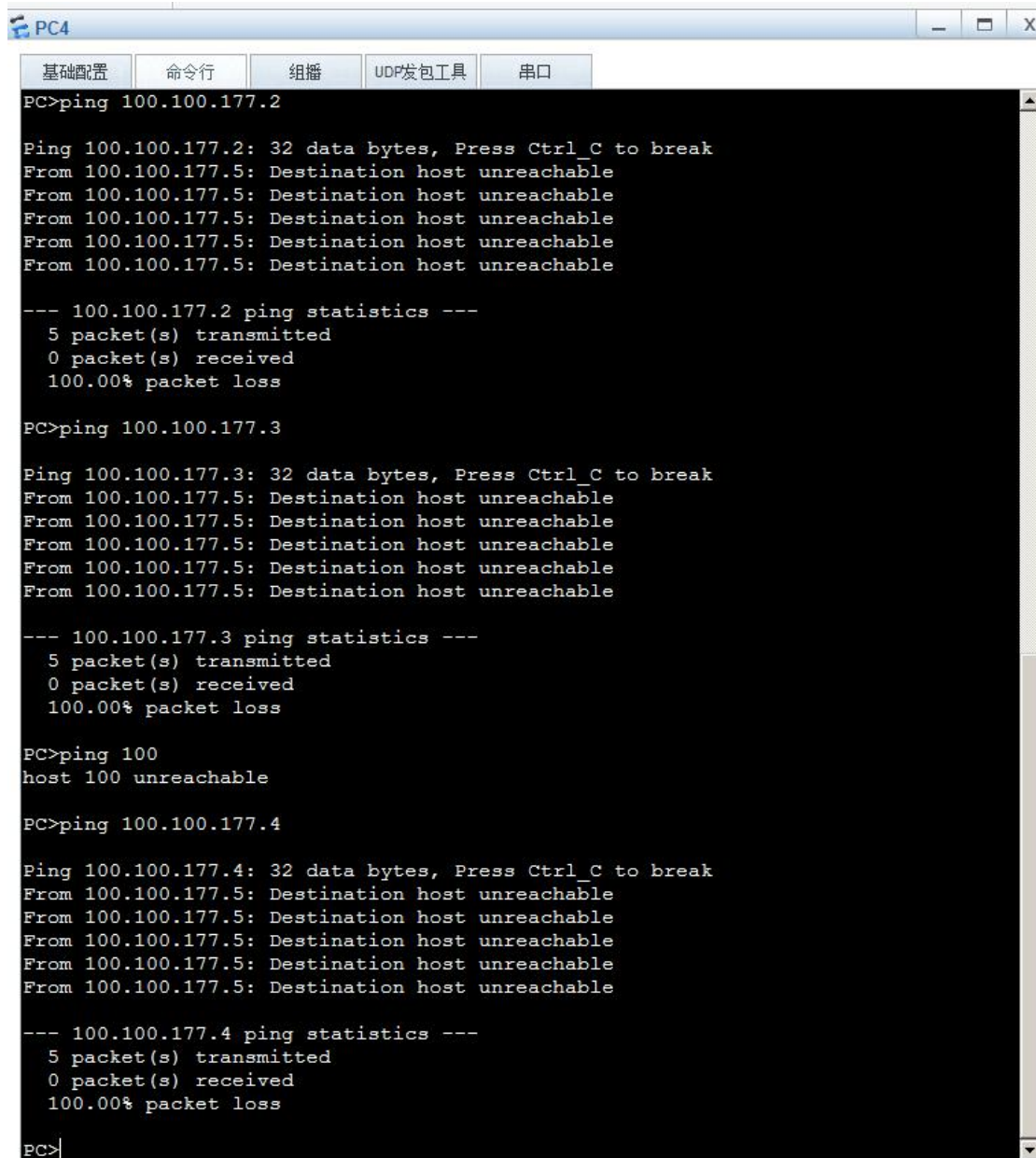
PC>ping 100.100.177.5

Ping 100.100.177.5: 32 data bytes, Press Ctrl_C to break
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable
From 100.100.177.4: Destination host unreachable

--- 100.100.177.5 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>|
```

测试 PC3 与 PC1、PC2 和 PC4 的连通性：



The screenshot shows a window titled "PC4" with a tabbed interface. The "命令行" (Command Line) tab is active, displaying a series of ping commands and their results. The results consistently show "Destination host unreachable" and "100.00% packet loss" for all tested IP addresses.

```
基础配置  命令行  组播  UDP发包工具  串口

PC>ping 100.100.177.2

Ping 100.100.177.2: 32 data bytes, Press Ctrl_C to break
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable

--- 100.100.177.2 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 100.100.177.3

Ping 100.100.177.3: 32 data bytes, Press Ctrl_C to break
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable

--- 100.100.177.3 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 100
host 100 unreachable

PC>ping 100.100.177.4

Ping 100.100.177.4: 32 data bytes, Press Ctrl_C to break
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable
From 100.100.177.5: Destination host unreachable

--- 100.100.177.4 ping statistics ---
 5 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>|
```

### 5. 结果及结论:

只有 PC1 和 PC2 可以连通, 其他均不连通, 是因为只有 PC1 和 PC2 与两个交换机连通的端口允许通过带有 VLAN10 标签的信息, 其他信息包会被丢弃, 从而实现虚拟局域网的隔离。

## 六、思考与体会

本次实验主要学习了 PPP 协议的配置, 完成了在两个路由器之间搭建 PPP 协议, 并完成握手认证, 明白了明文密码对于 PAP 认证方式的重要性。了解了交换机的端口类型以及用途, 学会了利用 Access 端口和 Trunk 端口进行交换机之间, 以及交换机与 PC 之间的连接通信, 知道了端口对于网络通信的作用, 以及组网的一般过程。